

Condor-G, Your Window to the Grid

Miron Livny
Computer Sciences Department
University of Wisconsin-Madison
miron@cs.wisc.edu
<http://www.cs.wisc.edu/~miron>



Believe it or not,

you

can do real science with

Grid resources



Here is what a group of
empowered
(and well organized)
scientists has been doing
with Grid resources ...



NUG28 - Solved!!!!

We are pleased to announce the exact solution of the nug28 quadratic assignment problem (QAP). This problem was derived from the well known nug30 problem using the distance matrix from a 4 by 7 grid, and the flow matrix from nug30 with the last 2 facilities deleted. This is to our knowledge the largest instance from the nugxx series ever provably solved to optimality.

The problem was solved using the branch-and-bound algorithm described in the paper "Solving quadratic assignment problems using convex quadratic programming relaxations," N.W. Brixius and K.M. Anstreicher. The computation was performed on a pool of workstations using the Condor high-throughput computing system in a total wall time of approximately 4 days, 8 hours. During this time the number of active worker machines averaged approximately 200. Machines from UW, UNM and (I NFN) all participated in the computation.

NUG30 Personal Grid ...

For the run we will be **flocking** to

- the main Condor pool at Wisconsin (600 processors)
- the Condor pool at Georgia Tech (190 Linux boxes)
- the Condor pool at UNM (40 processors)
- the Condor pool at Columbia (16 processors)
- the Condor pool at Northwestern (12 processors)
- the Condor pool at NCSA (65 processors)
- the Condor pool at INFN (200 processors)

We will be using **glide_in** to access the Origin 2000 (through LSF) at NCSA. We will use "**hobble_in**" to access the Chiba City Linux cluster and Origin 2000 at Argonne.

I t works!!!

Date: Thu, 8 Jun 2000 22:41:00 -0500 (CDT)

From: Jeff Linderot <linderot@mcs.anl.gov>

To: Miron Livny <miron@cs.wisc.edu>

Subject: Re: Priority

This has been a great day for metacomputing! Everything is going wonderfully. We've had over 900 machines (currently around 890), and all the pieces are working great...

Date: Fri, 9 Jun 2000 11:41:11 -0500 (CDT)

From: Jeff Linderot <linderot@mcs.anl.gov>

Still rolling along. Over three billion nodes in about 1 day!



www.cs.wisc.edu/condor

Up to a Point ...

Date: Fri, 9 Jun 2000 14:35:11 -0500 (CDT)

From: Jeff Linderot <linderot@mcs.anl.gov>

Hi Gang,

The glory days of metacomputing are over. Our job just crashed. I watched it happen right before my very eyes. It was what I was afraid of -- they just shut down denali, and losing all of those machines at once caused other connections to time out -- and the snowball effect had bad repercussions for the Schedd.

Back in Business

Date: Fri, 9 Jun 2000 18:55:59 -0500 (CDT)

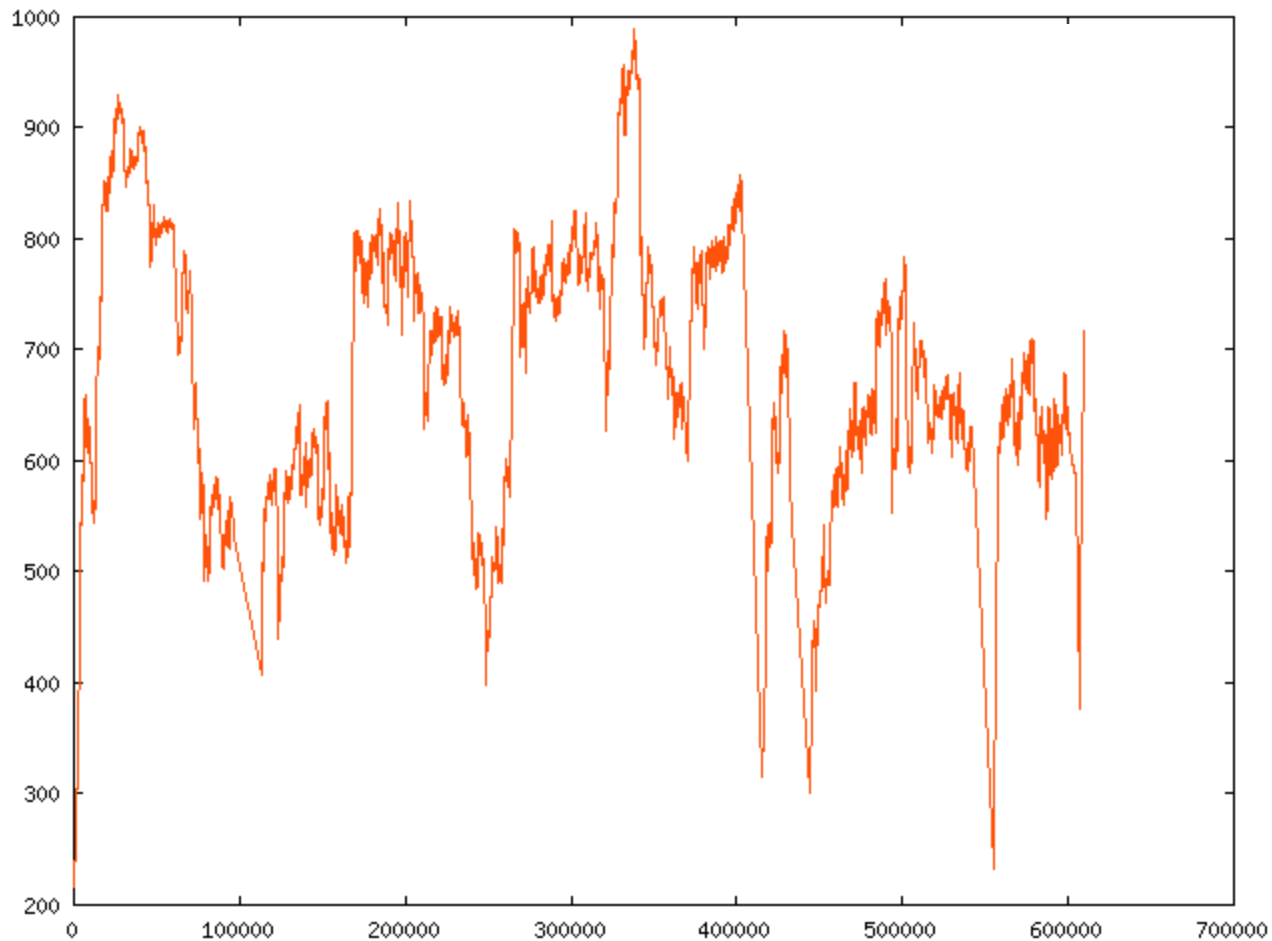
From: Jeff Linderot <linderot@mcs.anl.gov>

Hi Gang,

We are back up and running. And, yes, it took me all afternoon to get it going again. There was a (brand new) bug in the QAP "read checkpoint" information that was making the master coredump. (Only with optimization level -O4). I was nearly reduced to tears, but with some supportive words from Jean-Pierre, I made it through.

The First 600K seconds ...

Number
of
workers



NUG30 – Solved!!!

Sender: goux@dantec.ece.nwu.edu
Subject: Re: Let the festivities begin.

Hi dear Condor Team,

you all have been amazing. NUG30 required **10.9 years** of
Condor Time. In just **seven days** !

More stats tomorrow !!! We are off celebrating !

condor rules !

cheers,

JP.

**11 CPU years
in less than a week,
How did they do it?**

**Effective management
of their workforce!**

www.mcs.anl.gov/metaneos/nug30



www.cs.wisc.edu/condor

How did they do it?

Condor-G!

A Grid enabled version of Condor
(joint effort with the Globus Team)



Grid Problem Solving Environment/User

Condor - G

Globus

PBS

LSF

Condor

Glide-in

Glide-in

Glide-in

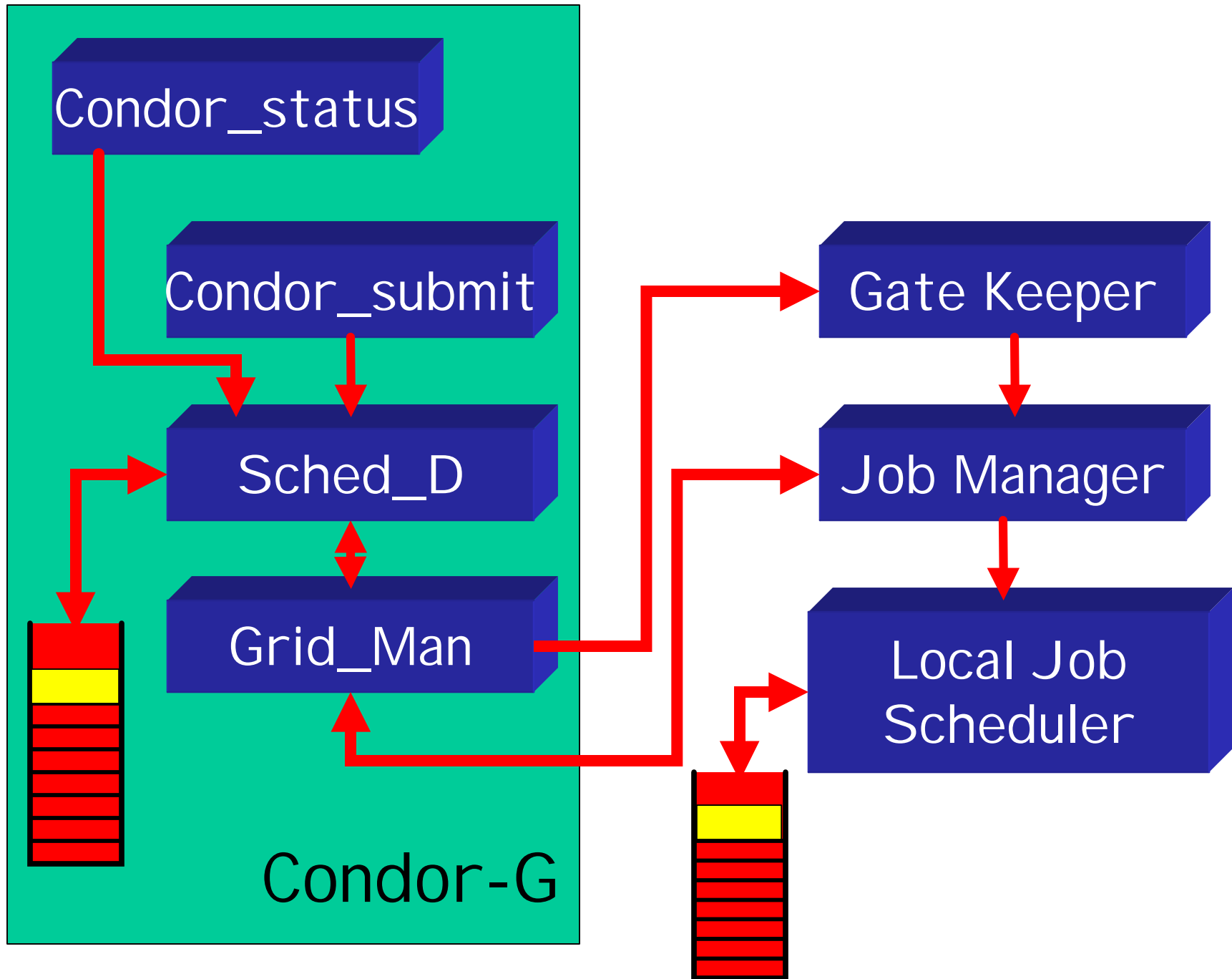
Condor

App

App

App

App



Adding the G to Condor

Step I

Add GSI based Authentication Services



Capabilities

- Submit process can be authenticated via a X509 certificate
- Basic certificate management services provided
- Certificates accessible to the Customer Agent (SchedD)
- Integrated support for a suite of authentication protocols



Open Issues

- Managing certificate expiration
- Managing certificate “wallets”
- Providing certificates to mobile/personal HW and SW
- X509-AFS interaction



Adding the G to Condor

Step II
Add support
for the
G Universe



Capabilities

- G jobs look and feel like a Condor job
- Local and personalized job management services
- Reliable and fault tolerant job management



Open Issues

- Provide “run once and only once” guarantees
- Dealing with failures/exceptions
- File staging
- Remote I/O
- Visibility of remote job and queue status information

Adding the G to Condor

Step III

Condor Glide-ins



Capabilities

- Turn allocated G resources into members of a Condor pool
- Use GSI FTP services to move Condor executable to executing environment
- Provide safeguards for broken communication lines
- Support SMPs and clusters for multi CPU allocations



Open Issues

- Manage inventory of glide-ins - how many? When to submit? Which G resource? Which queue?
- Package Condor software for automatic installation



Current Status

- Proof of concept (used by the NUGxx group) version of Condor-G available (based on Globus Run)
- New version of Condor-G will be released as a “Contrib Module” by the end of the month (based on GRAM API)
- “Glide-in” package available



Next steps

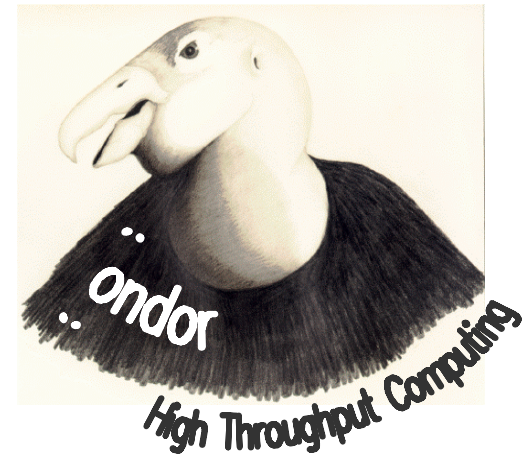
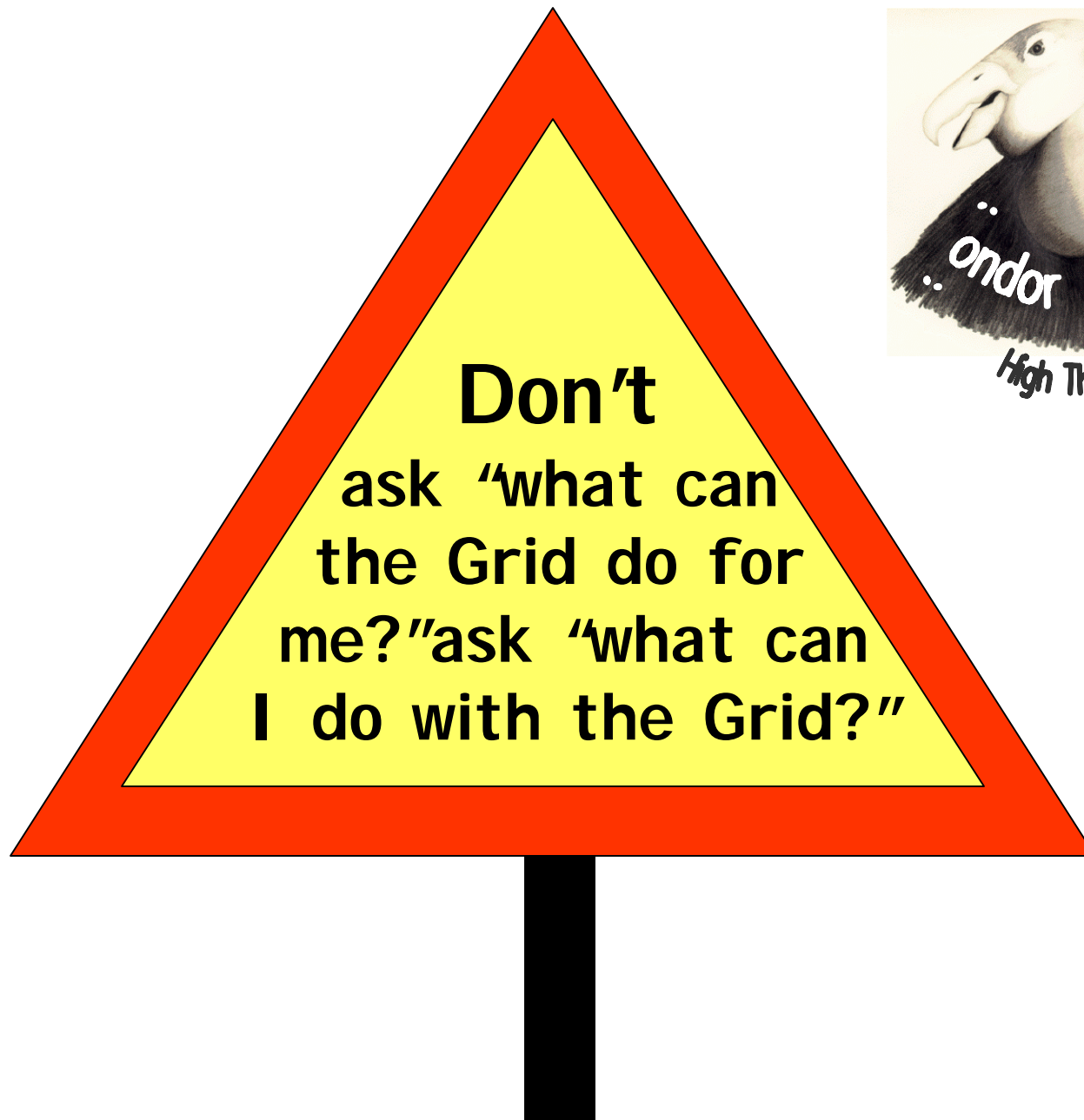
Add recoverability to Job Manager and Grid Manager:

- Re-attach to an existing job

- Make sure that a job is submitted once and only once

- Integrity of standard output and error files when redirected to submitting machine





- One G manager per user
- User select destination
- G manager uses GRAM API
- Use call backs for notification
- Does some polling to the JM.
- Information stored in the ClassAd
- Errors leads to job completinn with error message.
- Forward error messages from Globus to user.
- Next week will be done make it Contrib module by the end of the month.
- No support for Certificate experation (only at submit time)

- JM with re attach
- File transfers
- Submit one and only one